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FEE TRANSMITTAL
For FY 2005

[X] Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 170.00

Complete if Known	
Application Number	09/687,024
Filing Date	October 13, 2000
First Named Inventor	William C. Lindsey, et al
Examiner Name	Kevin M. Burd
Art Unit	2621
Attorney Docket No.	TITAN-55530

METHOD OF PAYMENT (check all that apply)

[X] Check [ ] Credit Card [ ] Money Order

[X] Deposit Account [ ] None

Deposit Account Number: 06-2425

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FEE CALCULATION

1. BASIC FILING FEE

Fee Description	Fee ($)	Small Entity Fee ($)	Fee Paid($)
Utility Filing Fee	790	395	
Design Filing Fee	350	175	
Plant Filing Fee	550	275	
Reissue Filing Fee	790	395	
Provisional Filing Fee	160	80	

Subtotal (1) $________

FEE CALCULATION (continued)

2. EXTRA CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20	18	9
Each independent claim over 3	88	44
Multiple dependent claims	300	150
For Reissues, each claim over 20 and more than in the original patent	18	9
For Reissues, each independent claim more than in the original patent	88	44

Total Claims		Extra Claims		Fee ($)		Fee Paid ($)
______	- 20 or HP =	______	x	______	=	______

HP = highest number of total claims paid for, if greater than 20

Indep. Claims		Extra Claims		Fee ($)		Fee Paid ($)
______	- 3 or HP =	______	x	______	=	______

HP = highest number of independent claims paid for, if greater than 3

Multiple Dependent Claims	Fee ($)	Fee Paid ($)

Subtotal (2) $________

3. OTHER FEES

Fee Description	Fee ($)	Small Entity Fee ($)	Fee Paid($)
1-month extension of time	110	55	
2-month extension of time	430	215	
3-month extension of time	980	490	
4-month extension of time	1,530	765	
5-month extension of time	2,080	1,040	
Information disclosure stmt. fee	180	180	
37 CFR 1.17(q) processing fee	50	50	
Non-English specification	130	130	
Notice of Appeal	340	170	
Filing a brief in support of appeal	340	170	170.00
Request for oral hearing	300	150	
Other:________			

Subtotal (3) $________

SUBMITTED BY					
Signature	Ellsworth R. Roston	Registration No. (Attorney/Agent)	16,310	Telephone	310-824-5555
Name (Print/Type)	ELLSWORTH R. ROSTON			Date	11-23-2004

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Donna M. Colon

Donna M. Colon

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	09/687,024
Applicant	:	WILLIAM C. LINDSEY and YOUNG M. KIM
Filed	:	October 13, 2000
Art Unit	:	2631
Examiner	:	Kevin M. Burd
Docket No.:	:	TITAN-55530
Customer No.	:	24201
Confirmation No.		9157

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

I. Related Appeals and Interferences

The real party in interest

Lincom Wireless, Inc.
5120 W. Goldleaf Circle
Suite 400
Los Angeles, CA 90056

An assignment from the Titan Corporation to Lincom Wireless, Inc. was recorded in the USPTO on March 25, 2002 in Real 013070, Frame 0394.

12/01/2004 WABDELR1 00000094 09687024

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II. Related Appeals and Interferences

There are no related appeals or interferences

III. Status of all of the Claims

Claims 12-97 are in the application. Claims 12-97 are involved in this appeal. Claims 1-11 have been cancelled from this application. Claims 1-11 have been filed in continuation application 10/892,871 on 07/16/04 (attorneys docket TITAN-69098).

IV. Status of Amendments

Applicants filed an amendment on February 2, 2004. In this amendment, applicants retained claims 1-97 in the application and amended a number of these claims. In an Office Action dated March 26, 2004, the Examiner finally rejected claims 1-97. On June 8, 2004, applicants filed an amendment under Rule 116 with respect to claims 1-97.

In an Office Action dated July 6, 2004, the Examiner refused to enter the amendment on the ground that the claims as amended "raised new issues that would require further consideration and/or search (see NOTE below.)" The Note stated:

"Applicant has added the term "simultaneously" to claims 1-11."

In response to the Office Action dated July 6, 2004, applicants cancelled claims 1-11 in an amendment filed in the USPTO on or about July 15, 2004. In this amendment, applicants requested the Examiner to enter applicants' amendment dated June 8, 2004 with respect to claims 12-97. On September 14, 2004, the Examiner submitted an Office Action. In this Office Action, the Examiner entered applicants' proposed amendment with respect to claims 12-97.

On September 27, 2004, applicants filed an appeal in the USPTO with respect to claims 12-97.

V. Summary of the Invention

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

Figure 1 schematically illustrates a system, primarily in block form and constituting a preferred embodiment of the invention, for sending data in digital form in a particular format from a transmitter (generally indicated at 10) to a receiver. The transmitter 10 includes a bus 12 for providing data input in a binary form. A channel encoder 14 may convert each binary signal to a number of binary bits indicating the different channels in which the data is provided. The inclusion of the channel encoder 14 is preferable but not mandatory.

The binary signals in the channel encoder 14 are introduced to a mapper 16. The mapper 16 provides binary indications identifying each of the channels. For example, the paired binary indications 01 could represent an upper right quadrant. Alternatively, the paired binary indications 01 could represent a lower left quadrant. The inclusion of the mapper 16 is preferable but is not mandatory.

The signals from the mapper 16 are modulated by a modulator 18. The modulations may be in a number of different forms each known in the prior art. For example, the modulations may be in the form of quadrature amplitude modulation (QAM), quadrature phase shift keying (QPSK) or star quadrature amplitude modulations (SQAM). The QAM modulations may illustratively be in 16QAM (where four (4) positions are provided in each of four (4) quadrants) or in 64 QAM (where sixteen (16) positions are provided in each of the four (4) quadrants.

A plurality of different modulations (e.g, M) are provided by the modulator 18. The M different modulations are produced respectively on a sequential basis of successive packets of digital signals. For example, a first modulation may be produced in a first packet or in a successive number of packets. A second modulation may then be produced in a second packet or

in a successive number of packets. Successive modulations may be sequentially produced in successive packets, or successive numbers of packets, until the M different modulations are produced. Thereafter, the cycle of M successive modulations is repeated for the packets in successive sequences on a repetitive basis.

The signals from the bus 12, the channel encoder 14, the mapper 16 and the modulator 18 are in serial form. They are converted to a parallel form by a serial-to-parallel converter 20 in a manner well known in the prior art. The parallel signals from the converter 20 are introduced to a plurality of multiplier stages respectively designated as 22a, 22b...22n. Each of the multipliers 22a, 22b...22n also respectively receives an individual one of a plurality of N spreading code signals on an individual one of lines 24a, 24b...24n.

Each of the N spreading codes respectively provided on an individual one of the lines 24a...24n may be produced at a different rate from the rate produced by the other ones of the N spreading codes. Thus, the multiplier 22a may multiply the modulated data $S_1(t)$ and the spreading code C_1 (t) where S_1 represents the first one of the M different data modulations and $C_1(t)$ represents the first one of the N spreading codes. Similarly, the multiplier 22b may multiply the modulated data $S_2(t)$ and the spreading code $C_2(t)$. An adder 26 receives the outputs from the multipliers 22a, 22b...22n. An amplifier may be included in the adder 26.

The data modulations $S_1(t)...S_m(t)$ have a bandwidth indicated at 28 in Figure 1. The spreading code signals $C_1(t)...C_n(t)$ have a bandwidth 30 which may be considerably larger than the bandwidth 28. The increased bandwidth 30 is advantageous in that it decreases noise in the transmitted and received signals and decreases the disadvantageous effects of out-of-phase signals. The out-of-phase signals are particularly disadvantageous because they can decrease the magnitude of the signals transmitted directly from the transmitter to the receiver. This results from the fact that the phases of the out-of-phase signals may be directly opposite to the phases of

the directly transmitted signal. Because of this, the increased bandwidth provided by the N spreading codes facilitates the recovery at the receiver of the in-phase data provided at the transmitter and transmitted directly to the receiver. The increased bandwidth is disadvantageous in that it slows the transmission of data from the transmitter to the receiver.

As will be disclosed in detail subsequently, it is known in the prior art to change one of the data modulations and the spreading codes without simultaneously changing the other one. However, it is not known in the prior art to change simultaneously the data modulations and spreading codes. Simultaneously changing both the data modulations and the spreading codes offers certain advantages. It strengthens the signals transmitted directly from the transmitter to the receiver against fading resulting from multi-path transmissions from the transmitter to the receiver. However, there is also a disadvantage. This may be seen from the relative bandwidths of the data modulations and the spreading codes. The data modulations have a bandwidth indicated at 28 in Figure 1 and the spreading codes have a bandwidth indicated at 30. As will be seen, the bandwidth 30 is significantly greater than the bandwidth 28. The increased bandwidth 30 facilitates the recovery of the data transmitted from the transmitter directly to the receiver from the fading resulting from multi-path passages of the data from the transmitter to the receiver. However, the increased range of the bandwidth 30 slows the transmission of data from the transmitter to the receiver.

Figure 2 schematically shows another system, generally indicated at 31 and primarily in block form, for sending data in a particular format from a transmitter to a receiver. The system 31 is designated as a single code system because there is only a single spreading code $C_1(t)$. This causes the rate of the orthogonal signals generated by the spreading code to be fixed. In this system, the number of different rates for the transmission of the data modulations is increased.

The transmitter shown in Figure 2 may include a channel encoder 14a corresponding to the channel encoder 14, a mapper 16a corresponding to the mapper 16, a modulator 18a

corresponding to the modulator 18 and a serial-to-parallel converter 20a corresponding to the serial-to-parallel converter 20. The parallel output from the converter 20 is introduced on a bus 32 to a multiplier 34 which also receives the spreading code $C_1(t)$. The transmitter shown in Figure 2 distinguishes over the prior art in providing for sequential changes in the data modulations and combining the sequentially changed data modulations with the constant spreading code $C_1(t)$.

In the transmitter shown in Figure 2, only the single spreading code $C_1(t)$ has been provided. Because of this, a number of the claims have been written with this in mind.

Figure 3 schematically illustrates a preferred embodiment of a transmitter, generally indicated at 40, of the invention. The transmitter 40 is primarily in block form and is preferred to the embodiments shown in Figures 1 and 2. The transmitter 40 includes a channel encoder 42, a mapper 44, a modulator 46 and a serial-to-parallel converter 48 respectively corresponding to the channel encoder 14, the mapper 16, the modulator 18 and the serial-to-parallel converter 20 in Figure 1.

In the system shown in Figure 3, assume that there are three (3) different data modulations and that there are five (5) different spreading codes. Under these circumstances, M would be 3 and N would be 5. The M data modulations are provided at the transmitter 40 in accordance with instructions from the receiver. In like manner, the N spreading codes are provided at the transmitter 40 in accordance with instructions from the receiver.

As shown in Figure 3, the three (3) data modulations are initially presented in a sequence as represented by the numerals 1, 2, 3 and the five (5) spreading codes are then presented in a sequence as represented by the numerals 4, 5, 6, 7, 8. The three (3) data modulations are then presented again in a sequence as represented by the numerals 9, 10, 11 and the five (5) spreading

codes are again presented in a sequence as represented by the numerals 12, 13, 14, 15, 16. Successive sequences of the data modulations and then the spreading codes are repeated in the manner specified above. It will be appreciated that a sequence of the successive spreading codes may be presented before a related sequence of the successive data modulation without departing from the scope of the invention.

The successive data modulations in a sequence are introduced from the serial-to-parallel converter 48 to a bus 50. This is indicated by the numerals 1, 2, 3 in a first column, and then by the numerals 9, 10, 11 in a second column, adjacent the bus 50 in Figure 3. In like manner, the successive spreading codes in a sequence are introduced from the serial-to-parallel converter 48 to a bus 52. This is indicated by the numerals 4, 5, 6, 7, 8 below the numbers 1, 2, 3 in the first column, and then by the numerals 12, 13, 14, 15 and 16 below the numbers 9, 10, 11 in the second column.

A selector 54 is provided for selecting one (1) of the M data modulations in each data modulation sequence and a selector 56 is provided for selecting one (1) of the N different spreading codes in each spreading code sequence. The selections by the stages 54 and 56 are paired. In other words, the M data modulations indicated as 1, 2, 3 for a time m=0 are paired with the N spreading codes indicated at 4, 5, 6, 7, 8 for a time m = 0. In like manner, the M data modulations indicated as 9, 10, 11 for a time m=1 are paired with the spreading codes indicated as 12, 13, 14, 15, 16 for the time m=1. The selections of the individual one of the M data modulations in each sequence and the individual one of the N spreading codes in each sequence may be made in accordance with instructions from the receiver. The selected one of the M data modulations in each sequence and the selected one of the N spreading codes in each sequence are combined as in a multiplier 58 and are introduced to a bus 60 for transmission to the receiver.

In the transmitter 40,

$$\log_2 M = K_m, \text{ where} \qquad (1)$$

M= a constant; and

K_m= a constant

In like manner,

$$\text{Log}_2\, N = K_n, \text{ where} \qquad (2)$$

N= a constant; and

K_n= a constant

Thus $K = K_m + K_n$, where (3)

K = a constant

K indicates the number of binary bits to be provided in the encoder 42 to indicate the number of different channels to be provided for the successive stages in the transmitter.

In Figure 3, b can be considered as the output from the channel encoder 42. Successive signals representing data modulations can be represented as

$b_1(m) = [b(mk), b(mk+1)...(b\ (mk + K_m -1)]$, where

m = a symbol time index indicated successively as 0, 1, 2, etc. (4)

b = the output from the channel encoder 42;

b_1 = the data modulations;

$b_2\ (m) = [b\ (mk + K_m), b\ (mk + K_m +1)...b\ (mk + k-1)]$, where (5)

b_2 = the spreading codes.

The system shown in Figure 3 has certain important advantages over the systems of the prior art and even over the systems shown in Figures 1 and 2 of this application. The system is better able to provide a distinction at the receiver between the data transmitted directly from the transmitter 40 to the receiver and phase-shifted data which limits the ability of the receiver to detect the in-phase signals from the transmitter. The system of Figure 3 provides this distinction between the data transmitted directly to the receiver from the transmitter and the phase-shifted signals by providing M data modulations and N spreading codes. The system of Figure 3 is also advantageous over the systems of Figures 1 and 2 because it is simpler than the systems shown in Figures 1 and 2 in selecting, for combination, only an individual one of the M data modulations in each sequence and only an individual one of the N spreading codes in each sequence. The system of Figure 3 is also advantageous in that it simultaneously selects the individual one of the M data modulations in each sequence and the individual one of the N spreading codes in each sequence.

The modulated data from the transmitter is received at a preferred embodiment of a receiver generally indicated at 70 in Figure 4. The receiver 70 may be of a correlator type and is shown primarily in block form. In a correlator type, the modulated data received at the receiver is introduced to a plurality of stages and is processed in a particular manner in each of these stages. The stage with the strongest signal is presumed to indicate the modulated data transmitted from the transmitter. It provides a correlation with the transmitted signal. This signal is then processed to recover the data in the modulated data transmitted to the receiver. A receiver of the correlator type is known in the art but not in the context or environment disclosed in this application and not with the combination of stages shown in Figure 4.

The signals are received at the receiver 70 on a bus 72. The signals on the bus 72 are introduced to multipliers 74a, 74b...74n. Each of the multipliers, 74a, 74b...74n receives an individual one of a plurality of spreading code signals C_1 (t), C_2 (t)...C_n(t) respectively on lines

75a, 75b...75n. The outputs of the multipliers 74a, 74b...74n are respectively introduced to individual ones of a plurality of integrators 76a, 76b...76n. Each of the integrators 76a, 76b...76n integrates the output of its associated multiplier from the time 0 to the time T. Thus, for example,

$$Z_1 = \ddot{y}_o{}^T Q_1 \; dt, \text{ where} \qquad (6)$$

Q_1 = the input to the integrator 76a; and

Z_1 = the output from the integrator 76a.

In like manner,

$$Z_n = \ddot{y}_o{}^T Q_n dt, \text{ where}$$

where Qn = the input to the integrator 76n; and

Zn = the output of the integrator 76n.

The output from each of the integrators 76_a, 76_b...76_n is partly real and partly imaginary. To convert the output of each of the integrators, 76_a, 76_b...76_n to an entirely real number, the absolute value of each of the outputs is squared. This is indicated at 78a, 78b...78n in Figure 4. For example, the squaring of the output from the integrator 76a may be indicated as $\ddot{y}Z_1 \ddot{y}^2$ and the squaring of the output from the integrator 76n may be indicated as $\ddot{y}Z_n\ddot{y}^2$. A comparison is then made in a comparator 80 of the magnitudes of the different outputs from the integrators after the different integrated outputs have been squared. The individual one of the integrators 76a, 76b...76n introducing integrated output to the squaring stage 78 and providing the output with the largest magnitude in the stage 78a, 78b...78n is then selected by a microprocessor 81 in a selector 82 on the basis of this comparison. The selected one of the integrators 76a, 76b...76n is then de-spread as at 83 to recover the modulated data. The de-spread data is then demodulated as at 84 to recover the data. The data is then analyzed on the basis of the guide lines provided by the mapper 16 and the channel encoder 14 at the transmitter to determine the significance of the data. The despreader 83 and the demodulator 84 are known in the prior art but not in the

combination shown in Figure 4 and not in the context or environment set forth in this application.

Figure 5 illustrates another preferred embodiment, generally indicated at 85, of a receiver. The receiver may be of a matched filter type and is shown primarily in block form. Since the receiver 85 receives from the transmitter information concerning various parameters such as individual ones of the M data modulations and individual ones of the N spreading codes, the receiver may include a plurality of filters each having characteristics matching the characteristics of a combination of an individual one of the M data modulations and an individual one of the N spreading codes. The plurality of matched filters are indicated at 86a, 86b...86n in Figure 5 and are shown as receiving through a bus 88 the signals from the transmitter.

Each of the filters 86a, 86.....86n also receives a signal corresponding to the output capable of being provided by an individual one of the combinations of an individual one of the M data modulations and an individual one of the N spreading codes. As previously indicated, the receiver 85 knows the M data modulations and the N spreading codes since the receiver instructs the transmitter to use these data modulations and spreading codes. Because of this, each of the filters 86a, 86b...86n is able to match the characteristics of an individual one of the transmitted signals.

For example, the matched filter 86a receives signals on a line 90a. One of these signals corresponds to a combination of b(mk) and b(mk + km). The filter 86a passes the signal constituting the combination of b(mk) and b(mk + km) because of the matching characteristics of the filter with the signal provided on the line 90a. Similarly, the matched filter 86b receives signals on a line 90b. One of the signals may correspond to a combination of b (mk + 1) and b(mk + km + 1). When the signal received from the transmitter constitutes a combination of

b (mk + 1) and b (mk + km + 1), the filter 86b passes the signal because of the matching characteristics of this filter with the signal provided on the line 90b. The magnitudes of the signals passing through the matched filters 86a, 86b...86n are compared in a comparator 88. A microprocessor 90 receives the signals from the comparator 88 and selects in a stage 92 the signals with the greatest magnitude from the matched filters 86a, 86b...86n. The signal passing through the selected one of the matched filters 86a....86n at each instant is despread in a despreader 94 and demodulated in a demodulator 96 in a manner similar to that described for the embodiment shown in Figure 4.

Figure 6 shows a transmitter, generally indicated at 100, in a schematic block form. The transmitter 100 is included in a preferred embodiment of the invention. The transmitter 100 can include features of the transmitter shown in any one of Figures 1-3 and described above. The data bits are introduced through a bus 102 to an encoder 104 for encoding channels. For example, the channel encoder may provide an encoding for K channels in accordance with equation (3) set forth above. The encoder 104 may be a convolutional or turbo type of encoder. Instructions on a line 105 from the receiver shown in Figure 7 determine the encoding of the channels. A channel encoder corresponding to the channel encoder 104 is known in the prior art but not in the combination shown in Figure 6 and not for the purposes set forth in this application.

The output from the channel encoder 104 passes to a puncturer 106. A puncturer corresponding to the puncturer 106 is known in the prior art but not for purposes set forth in this application and not in the combination shown in Figure 6. The puncturer 106 deletes some of the output from the channel encoder 104 to provide for the transmission of data at an efficient and effective code rate. When the code rate of the encoder 104 is R_c = k/n and l coded bits are punctured out of each (n) (P) coded bits, the effective code rate is R_c = (KP) (nP-l). The puncturing may be provided at the transmitter in accordance with instructions from the receiver.

The instructions may be provided through a bus 108. In the above equation, K is derived from equation (3).

After puncturing, the coded bits are interleaved as at 110. Interleaving is known in the prior art. The interleaved bits are then mapped into an individual one of the modulation symbols in the selected modulation scheme. This may be provided in accordance with the system shown in Figure 3 and described above. In mapping the interleaved output bits, Gray labeling may be used. The interleaved data is then modulated as at 114. The data modulations may be provided in accordance with instructions from the receiver. The data modulations may be provided through the bus 108.

The data modulation may consist of M subsets which are orthogonal to one another and each subset may have V original points. The modulation may be selected from a number of different modes including QPSK, QAM and SQAM. The selection of the puncturing and modulation schemes is based upon the channel condition information fed back by the receiver and other sources (for example, other base stations in the cellular radio system). Each modulation symbol may be produced at a rate R_S with a period of $T_S = 1/R_S$. Each modulation may be spread by a spreader 116 such as the spreader shown in Figure 3 and described above. The spreading may be by an orthogonal sequence of a length N_C. The spreading code may be provided through a bus 118. The output from the spreader 116 is provided on a bus 120.

Each modulation symbol may be spread by an orthogonal sequence of a length N_C. The chip rate Rchip has a fixed value (Nc)(Ks) to provide the transmitted signal with a substantially constant bandwidth. The maximum length of the spreading sequence may be denoted as Nc, max. Thus, the data rate Rb is

$$Rb = (Rce) \log_2 (LM) (Rchip)/NC$$

$$Rb = (Rcc) \log_2 (VM) Rchip/Nc)$$

The determination of the spread factor (Nc) of the spread code is based upon the delay spread observed at the receiver. (Nc) is chosen to be sufficiently large to avoid inter-symbol interference (ISI) caused by the delay spread of the multipath fading channel. As previously described, multipath fading channels occur when the data transmitted from the transmitter to the receiver also reaches the receiver through paths other than directly from the transmitter to the receiver. These indirect paths can produce inter-symbol interference (ISI) and can cause fading of the data transmitted directly from the transmitter to the receiver.

Although the individual ones of the stages shown in Figure 6 are known in the prior art, the combination of the stages shown in Figure 6 is not believed to be known in the prior art. Furthermore, the combination of stages shown in Figure 3 and described above is not believed to be known in the prior art. This is particularly true when the combination of stages shown in Figure 3 is used as the modulator 114 and the spreader 116 in Figure 6. The combination of stages shown in Figures 1 and 2 can also be used as the modulator 114 and the spreader 116 in Figure 6. In addition, although the puncturer 106 and the interleaver 108 provide advantages in the construction and operation of the transmitter 100 shown in Figure 6, they can be removed from the transmitter without departing from the scope of the invention.

Figure 7 is a schematic block diagram of a receiver, generally indicated at 120, which can be used with the transmitter 100 shown in Figure 6. The signals received by the receiver 120 are introduced to a bus 122 which is connected to a despreader 124. The construction of a despreader such as the despreader 124 is known in the prior art but not in the combination as shown in Figure 7 and not for the purposes set forth in this application The despreader 124 eliminates the effects of the spread codes introduced to the modulated data at the transmitter such as the spreader 116 in Figure 6. The despreader 124 may operate in accordance with the instructions introduced from the receiver to the spreader 116 in Figure 6.

The signals on the bus 122 are also introduced to a channel estimator 126 which estimates the characteristics of the channel in which the signals have been transmitted to the receiver. For example, the channel estimator 126 may operate in accordance with the value K, the number of channels specified in accordance with equation (3) specified above. The signals from the channel estimator 126 pass to lines 128 and 130. The line 128 provides the index for the spreading provided by the spreader 116 in Figure 6. The line 130 provides the index for the data modulations provided by the data modulator 114 in Figure 6.

After the received signals have been despread by the despreader 124, the modulations in the data are then removed in a demodulator 132. The demodulator 132 eliminates the modulations in the data in accordance with the instructions introduced from the receiver to the data modulator 114 in Figure 6. The demodulated data may then be introduced to a metric computer 134 which processes the data into a metric form and introduces the processed data to a deinterleaver 136.

The deinterleaver 136 restores the data to the form in which it existed before it was introduced to the puncturer 106 in Figure 6. A stage 138 designated as erasure inserter in Figure 7 restores the data to the form in which it existed before it was introduced to the puncturer 106 in Figure 6. A decoder 140 in Figure 7 restores the data to the form in which it was introduced to the channel encoder 104 in Figure 6.

Individual ones of the despreader 124, the demodulator 132, the metric computer 134, the deinterleaver 136, the erasure insertion stage 138 and the decoder 140 are known in the prior art but the combination shown in Figure 7 is not believed to be known in the prior art. Furthermore, the combination is not known in the prior art for the purposes set forth in this application When the puncturer 106 and/or the interleaver 108 are not included in the transmitter shown in Figure

6, the deinterleaver 136 and/or the erasure insertion stage 138 will not be included in the receiver shown in Figure 7.

Assume that a block or packet of data spans a time duration of T_B and that the block or packet of data is transmitted by the transmitter 100 to the receiver 120 at successive instants of time. Assume also that the time interval between consecutive transmitted blocks or packets is T_{FD}. The time interval T_{FD} may correspond to the delay in the feedback from the receiver 120 to the transmitter 100 of information relating to the channel conditions. As previously indicated, the signal received by the receiver 120 from the transmitter 100 are processed to decode the transmitted data bits and recover the transmitted data. The received signal is also used to estimate the local average of the channel conditions. The term "local average" is intended to mean that averaging is provided over the time span of T_B, the duration of a block or packet of data.

The relative speed between the movements of the transmitter 100 and the receiver 120 helps to determine the dynamics of the channel conditions. At a low speed of relative movements between the transmitter 100 and the receiver 120, the channel condition can be almost constant over a time duration of T_B or even over a multiple number of time durations of T_B. At a high speed of relative movements between the transmitter 100 and the receiver 120, the channel condition can fluctuate many times over a wide range of values over the same time period of T_B or a multiple number of time durations of T_B.

The characteristics of the time-varying multipath fading channels include the local average of signal-to-noise ratio (SNR), where noise represents all of the components other than the desired signal, delay spread and variability of the desired signal amplitude level among other things. The amount of the delay spread determines the level of inter-symbol interference (ISI) and cross interference between the transmitted orthogonal signal components. In the preferred

embodiments of this invention, increasing the spreading factor can reduce the level of the inter-symbol interference (ISI). Furthermore, it also enhances the capability of suppressing interference of the transmitted spread spectrum signal and helps to maintain the orthogonality between the transmitted signals. It also has an effect of lengthening the duration of the modulation symbols. Spreading factor can be defined as the ratio between the chip rate of the spreading codes and the rate of the data modulations.

Thus, depending upon the level of the delay spread observed in the spreading codes, the spreading factor is selected to provide sufficient protection against the inter-symbol interference (ISI) and against the cross interference. This will simplify the processing complexity of the receiver signal by avoiding equalization or other techniques of interference suppression. Assuming that the spreading factor selected is sufficiently large to suppress the delay spread efforts of the multipath fading channel, the channel characteristic observed at the receiver 120 after despreading can be modeled by a flat fading channel. The performance at the receiver will accordingly depend upon the local average signal-to-noise ratio (SNR) and the variance of the desired signal level. The optimal combination of code rate (or puncturing) and the scheme of the data modulations is determined based upon the two (2) aspects of the channel characteristics.

This invention provides for a combination of a channel code rate, data modulation and spreading code. This combination is provided to enhance the spectral efficiency achievable even with the deteriorations resulting from multipath fading channels. A set of orthogonal spreading sequences may be used for spreading, and a determination of the spreading factor (or processing gain) is made based upon the channel impulse response to provide sufficient protection against the channel effects, such as delay spread, of multipath fading.

Different channel code rates may be obtained by puncturing simple basic convolutional or turbo code so that a single decoder can be used for different combinations of code rate and

data modulation. After selecting the spreading factor, channel code rate and data modulation are determined based on local average channel conditions instead of instantaneous channel conditions. Then the number of orthogonal spreading sequences is determined based on the user's data rate specification.

By selecting spreading factor, code rate and data modulation, targeted data rate can be achieved by using a minimal amount of radio resources under time-varying channel conditions. In adapting spreading factor, code rate and data modulation, it is important to realize that feedback delay in having the receiver inform the transmitter of channel conditions will be unavoidable. Because of this, it is important to realize that adaption by the system shown in Figures 6 and 7 should be based upon local average channel conditions. This provides for a successful adaptation by the system shown in Figures 6 and 7. It should also be appreciated that the system should also be based upon local average channel conditions when the transmitter 100 shown in Figure 6 is adapted to incorporate any of the systems shown in Figures 1-3 and/or when the receiver 120 shown in Figure 2 is adapted to incorporate either of the systems shown in Figures 4 and 5.

Solely relying on either one of the two (2) techniques of data modulation and spreading code to provide communication services at high data rates will cause the system to be inefficient or make the modem implementation inordinately complicated. By combining channel encoding, direct sequence spreading and adaptive coded modulation, high data rate wireless communication services can be provided reliably and efficiently.

The summary set forth above on pages 3-18 of this Appeal Brief have been obtained from page 8, line 3 to page 28, line 16 of the specification.

VI. Issues

A. Is there a disclosure in the prior art cited by the Examiner of a method including the steps of providing sequences of M data modulations and sequences of N spreading codes, selecting an individual one of the M data modulations in each M data modulation sequence and an individual one of the N spreading codes in each N spreading code sequence, combining the selected one of the M data modulations in each M data modulation sequence and the selected one of the N spreading code in each N spreading code sequence and transmitting to a receiver the combination of the selected one of the M data modulations in each M data modulation sequence and the selected one of the N spreading codes in each N spreading code sequence?

B. Is there a disclosure in the prior art as specified in paragraph A that the M data modulations are produced in first sequences and the N spreading codes are produced in second sequences which are alternately provided with the first sequences?

C. Is there a disclosure in the prior art as specified in paragraph B that the M data modulations in each of the first sequences and the N spreading codes in each of the alternately provided second sequences are provided in parallel pairs and that an individual one of the data modulations in each of the first sequences and an individual one of the spreading codes in each of the alternately provided second sequences in each parallel pair are selected for combination?

D. Is there a disclosure in the prior art as specified in paragraph C that the sequences of the M data modulations are provided on a reiterative basis and the sequences of the N spreading codes are provided on a reiterative basis and that the selected one of the M data

modulations in each data modulation sequence and the selected one of the N spreading codes in each alternately provided spreading code sequence are combined?

E. Is there a disclosure in the prior art as specified in paragraph D that the selection of an individual one of the M data modulations in each data modulation sequence and the selection of an individual one of the N spreading codes in each spreading code sequence are provided in accordance with instructions from a receiver which receives the selected signals from a transmitter?

F. Is there a disclosure in the prior art as specified in paragraph E that the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each alternately provided spreading code sequence constitutes a multiplication of the selected one of the M data modulations and the selected one of the N spreading codes?

G. Is there a disclosure in the prior art of a method of receiving at a receiver signals transmitted from a transmitter and constituting a combination of a selected one of M data modulations in a data modulation sequence and a selected one of N spreading codes in an alternately provided spreading code sequence and of identifying, from the different combinations of the M data modulations in the data modulation sequence and the N spreading codes in the alternately provided spreading code sequence, the combination of the selected one of the M data modulations in the data modulation sequence and the selected one of the N spreading codes in the alternately provided spreading code sequence?

H. Is there a disclosure in the prior art of a method as specified in paragraph G of identifying at the receiver by correlation techniques the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each alternately provided spreading code sequence?

I. Is there a disclosure in the prior art of a method as specified in paragraph H of identifying the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each alternately provided spreading code sequence by correlation techniques such as shown in Figure 4 of the drawings and described in the specification?

J. Is there a disclosure in the cited prior art of a method as specified in paragraph G of identifying by matched filter techniques the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each alternately provided spreading code sequence?

K. Is there a disclosure in the cited prior art that the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each alternately provided spreading code sequence is identified by correlation techniques as specified in paragraph H and is then despread to identify the selected one of the N spreading codes in the spreading code sequence and is thereafter demodulated to identify the selected one of the M data modulations in the data modulation sequence?

L. Is there a disclosure in the cited prior art that the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each alternately provided spreading code sequence is identified by matched filter techniques as specified in paragraph J and that the identified combination is then

despread to identify the selected one of the N spreading codes in each spreading code sequence and is thereafter demodulated to identify the selected one of the M data modulations in each data modulation sequence?

VII. Grouping of Claims.

The Examiner has specified different groupings for individual claims in claims 12-97. These groupings of claims by the Examiner are as follows:

A. Claims 12-18, 21, 29-34, 43, 44, 47, 49, 51, 54-57, 59, 75-79, 84-90 and 95-97 have been rejected under 35 U.S.C. 102(b) as being anticipated by Tanaka patent 5,781,542.

B. Claims 19, 20, 22-24, 80-83, 91, and 92 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka patent 5,781,542 in view of Fulghum patent 5,345,569.

C. Claims 25-28, 41, 42, 93 and 94 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Park patent 6,160,840 in view of Tanaka patent 5,781,542.

D. Claims 35-40, 45, 46, 48, 50, 52, 53, 58, 60 and 67 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka patent 5,781,542 in view of Park patent 6,160,840.

E. Claims 61-63 and 66 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka patent 5,781,542 in view of Lee patent 6,111,868.

F. Claims 64 and 65 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka patent 5,781,542 in view of Lee patent 6,111,868 and further in view of Park patent 6,160,840.

G. Claims 68-70 and 73 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka patent 5,781,542 in view of Lee patent 6,11,868 and further in view of Fulghum patent 5,345,469.

H. Claims 71, 72 and 74 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka patent 5,781,542 in view of Lee patent 6,111,858 in further view of Fulghum patent 5,345,409 in view of Park patent 6,160,840?.

The claims in each of groups A-H as specified above do not stand or fall together as will be seen from the subsequent discussion. As will also be seen from the subsequent discussion, applicants have classified the claims in groups which are different from the claims as grouped by the Examiner. Applicants also explain subsequently why the claims in each of applicants' groups are patentably distinguished from the claims in applicants' other groups and patentably distinguished from the prior art cited by the Examiner against the claims. Applicants also explain subsequently why the claims in each of applicants' groups stand or fall together.

A. Claims 12-18, 21, 29-34, 43, 44, 47, 49, 51, 54-57, 59, 76-79, 84-90 and 95-97 classified by the Examiner in a single group.

Group 1. Claim 12.

Claim 12 recites the steps of providing a plurality of modulations in each of a plurality of M data modulation sequences, providing a plurality of spreading codes in each of a plurality of N spreading code sequences, selecting an individual one of the data modulations in each M data modulation sequence, selecting an individual one of the spreading codes in each N spreading code sequence, combining the selected one of the data modulations in each M data modulation sequence and the selected one of the spreading codes in each N spreading code

sequence and transmitting the combination to a receiver. This is not disclosed in any of the prior art references cited by the Examiner.

Group 2. Claims 55, 58, 59, 84 and 95.

Claims 55, 58, 59, 84 and 95 include a recitation that the M data modulations and the N spreading codes are provided in parallel pairs. This parallel presentation facilitates and enhances the selection of the individual one of the M data modulations and the selection of the individual one of the N spreading codes. The recitation of the parallel presentation causes claims 55, 58, 59, 84 and 95 to be distinguished patentably from claim 12. The combined recitations in claim 12 and in claims 55, 58, 59, 84 and 95 cause claims 55, 58, 59, 84 and 95 to be allowable over the references cited by the Examiner for the same reasons as claim 12 and for the additional reason that the cited references do not disclose parallel presentations.

Group 3. Claims 13-18.

Claims 13-18 recite that the sequences of the N spreading codes are provided alternately with the sequences of the M data modulations. This alternate presentation facilitates the selection of the individual one of the M data modulations in each data modulation sequence and the individual one of the N spreading codes in each alternately provided spreading code sequence. This alternate provision of the data modulation sequences and the spreading code sequences causes claims 13-18 to be distinguished patentably over the claims listed immediately above in groups 1 and 2 and to be allowable over the prior art cited by the Examiner.

Group 4. Claim 51, 54 and 87.

Claims 51, 54 and 87 recite a step of combining on a reiterative basis a selected one of the M data modulations in each data modulation sequence and a selected one of the N spreading codes in each spreading code sequence to produce resultant signals and also recites a step of transmitting the combination of the selected signal in each data modulation sequence and the selected signal in each spreading code sequence to a receiver. The recitation of performing the different steps on a reiterative basis causes claim 51, 54 and 87 to be distinguished patentably over the prior art and the other claims specified above.

Group. 5. Claims 25, 26, 52, 60 and 93.

Claims 25, 26, 52, 60 and 93 recite that the sequence of the M data modulations and the sequence of the N spreading codes are provided in accordance with instructions from a receiver. This is not disclosed in the cited prior art and in the other claims specified above. Because of this, claims 25, 26, 52, 60 and 93 are distinguished patentably over the cited prior art and over the other claims specified above.

Claims 25, 26 and 93 have been analyzed by applicants out of order since they have been classified by the Examiner in Group C. Claims 52 and 60 have also been analyzed by applicants out of order since they have been classified by the Examiner in Group D.

Applicants have analyzed claims 25, 26, 52, 60 and 93 out of order since they have been classified by applicants to be in group 5 and there is a natural progression of increasing priority from group 1 through group 6.

Group 6. Claims 29-34, 43, 44, 47, 49, 56, 57, 59, 75-79, 85, 86, 88, 89, 96 and 97.

Claims 29-34, 43, 44, 47, 49, 56, 57, 59, 75, 76, 77, 78, 79, 85, 86, 88, 89, 96 and 97 recite that the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence constitute the product of the selected data modulation and the selected spreading code. This is not disclosed in the prior art. It also constitutes a patentable distinction over what is recited in the claims specified for inclusion in groups 1-5 immediately above.

Group 7. Claims 21 and 90.

Claims 21 and 90 are included in Group A. The claims in Group A have been rejected as anticipated by Tanaka. All of the claims in Group A (except for claims 21 and 90) relate to a transmitter. Claims 21 and 90 relate to a receiver but not a transmitter. Claims directed to a receiver but not a transmitter should not be included in a group with claims relating to a transmitter but not a receiver. This is particularly true since claims 21 and 90 recite the steps of despreading and demodulating and Tanaka does not disclose these steps.

Claims 21 and 90 should properly be classified in a separate Group 7. Claims 21 and 90 do not stand or fall with the other claims in the Examiner's section A since they relate to the receiver (without the transmitter) rather than the transmitter (without the receiver). Claims 21 and 90 are allowable over the prior art since they recite the step of identifying the combination of the selected one of the M data modulations in the data modulation sequence and the selected one of the N spreading codes in the spreading code sequence.

The claims listed above in groups 1-6 are in an order of increasing priority. In other words, the claims in group 6 have a higher priority than the claims in groups 1-5 and the claims in group 5 have a higher priority than the claims in group 1-4. Some of the claims recite the features that are individual to more than one of groups 1-6. When the claims have been able

to be listed in more than one group, the intent has been to list them in the group of highest priority. This is why many of the claims have been listed in group 6.

It may be that invalidating prior art may exist with respect to the claims in a group of high priority. In such an occurrence, the claims in that group will probably be unpatentable in that group but may still be patentable if they are classified in a group of reduced priority and if there is no invalidating prior art in that group. For example, if a claim classified in group 5 can also be classified in group 3, the claim would be allowable if there is invalidating prior art in group 5 but no invalidating prior art in group 3.

B. Claims 19, 20, 22-24, 80-83, 91 and 92 classified by the Examiner in a single group.

Claims 19, 20, 22-24, 80-83, 91 and 92 have been rejected as unpatentable over Tanaka in view of Fulghum. They do not stand or fall together as will be seen from the subsequent discussion. These claims may be classified in the following groups each of which can be distinguished patentably from other claims in this Section B and from groups 1-7 in Section A:

Group 8. Claim 19.

Claim 19 is dependent from claim 16 which is in turn dependent from claim 14. Claims 14 and 16 have been classified in group 3. Claim 19 include a recitation of a combination of a transmitter and receiver and the use in the receiver of correlation factors to identify the combination of the selected one of the M data modulations and the selected one of the N spreading codes. The use of correlation factors to identify the selected combination is shown in Figure 4. The use of correlation factors in a receiver to identify the selected

combination is not recited in any of the claims in groups 1-7 and is not disclosed in the prior art cited by the Examiner. It accordingly should be classified separately in group 8.

Group 9. Claim 20.

Claim 20 is also dependent (but indirectly) from claim 16. It includes a recitation of the use in a receiver of matched filters. It is not recited in any of the claims in groups 1-8. It should accordingly be classified separately in group 9. Furthermore, none of the cited references discloses the steps recited in the combination of claims 14, 16, 18 and 20. For example, none of the cited references discloses the identifying step recited in claim 16.

Group 10. Claims 22 and 91.

Claim 22 is dependent from independent claim 21. Claim 21 recites a receiver (but not a transmitter). Claim 22 recites the use of correlation factors in the receiver to identify the combination of the selected one of the M data modulations and the selected one of the N spreading codes. It should accordingly be classified separately in group 10 since it recites only a receiver (but not a transmitter). Claim 91 also recites a receiver (but not a transmitter) and the use of correlation factors in the receiver to identify the combination of the selected one of the M data modulations and the selected one of the N spreading codes. None of the claims in groups 1-9 recites an identification by correlation factors of a combination of a selected one of M data modulations and a selected one of N spreading codes by correlation factors. Claims 22 and 91 are accordingly allowable over the references cited by the Examiner whether the references are applied individually or in combination against the claims.

Group 11. Claims 23 and 92.

Claim 23 is dependent from independent claim 21. Claim 21 recites a receiver (but not a transmitter). Claim 23 recites the use of matched filter techniques in the receiver to identify the combination of the selected one of the M data modulations and the selected one of the N spreading codes. It should accordingly be classified separately since it recites only a receiver (but not a transmitter) and since it recites the matched filter technique for identification. Claim 92 provides recitations similar to those provided in claim 23. None of the claims in groups 1-10 provides the recitations of claims 23 and 92. Furthermore, none of the references cited by the Examiner discloses the method recited in claims 23 and 92.

Group 12. Claim 24.

Claim 24 is dependent from claim 22. It recites a number of steps in the use of correlation techniques. These include the multiplication of the received data by each individual one of the N spreading codes, the integration of the products with time and the identification of the combination of the selected one of the M data modulations and the selected one of the N spreading codes by the highest value in the squaring of the integrated products. These are patentable features, particularly in applicants' receiver. Claim 24 should accordingly be classified in a separate group 12. Claim 24 is also allowable for the reasons discussed above over the references cited by the Examiner whether the references are applied individually or in combination against the claims.

Group 13. Claim 80.

Claim 80 is dependent from claim 79, claim 79 is dependent from claim 78 and claim 78 is dependent from claim 14. Claim 78 recites that the combining of the selected one of the M data modulations and the selected one of the N spreading codes is in parallel and is

defined by the selected one of the M data modulations and the selected one of the N spreading codes. This causes claim 80 to be related to group 2 and to be allowable over the prior art for the same reasons as the claims in group 2. However, it is patentably distinguished from group 2 and from the cited prior art because of the recitations in claim 80, particularly the recitation of the use of correlation techniques to identify at the receiver the combination of the selected one of the M data modulations and the selected one of the N spreading codes. Since claim 80 recites features identified with group 2 and features identified with group 8, claim 80 should be classified in a separate group 13.

Claim 81 should be included in group 6.

Claim 82 should be included in group 13.

Claim 83 should be included in group 13 with claim 80.

Claim 91 is dependent from claim 90 which recites a receiver using correlation techniques. It should be included in group 10 with claim 22.

Claim 92 is dependent from claim 91 which recites a receiver using matched filter techniques. Claim 92 should be included in group 11 with claim 23.

C. Claims 25-28, 41, 42, 93 and 94 classified by the Examiner in a single group.

Claims 25-28, 41, 42, 93 and 94 have been rejected as unpatentable over Park in view of Tanaka. These claims do not stand or fall together. This will be seen from the subsequent discussion. Applicants suggest that claims 25-28, 41, 42, 93 and 94 should be grouped as follows with the claims in each group being patentably distinct from the claims in the other groups for the reasons specified above:

Claim 25

See group 5 above

Claim 26

See group 5 above

Claim 27

Claim 27 should be classified in group 6 with claims 29-34, 43, 44, 47, 49, 56, 57, 59, 75, 76, 77, 78, 79, 85, 86, 88, 89, 96 and 97.

Claim 28

Claim 28 should be classified in group 6 with the claims specified in the paragraph immediately above relating to claim 27.

Group 14. Claim 41

This claim relates to a receiver (but not including a transmitter). The claim recites that the received data constitutes a product of a data modulation selected from M data modulations in a data modulation sequence and a spreading code selected from N spreading codes in a spreading code sequence. Since the claim recites a receiver and not a transmitter, it is patentably different from the other claims discussed above and it does not stand or fall with the other claims. Claim 41 has been classified in a new group 14.

Claim 42

Claim 42 should be classified in group 14 with claim 41.

Claim 93

See group 5 above.

Claim 94

Claim 94 should be classified in group 6 with the other claims in that group.

D. Claims 35-40, 45, 46, 48, 50, 52, 53, 60 and 67 classified by the Examiner in a single group.

Claims 35-40, 45, 46, 48, 50, 52, 53, 60 and 67 have been rejected as unpatentable over Tanaka in view of Parks. These claims do not stand or fall together as a group as will be seen from the subsequent discussion. Applicants respectfully submit that claims 35-40, 45, 46, 48, 50, 52, 53, 58, 60 and 67 should be grouped as follows with the claims in each group being patentably distinct from the claims in the other groups for the reasons specified above:

Claim 35

Claim 35 should be classified in group 6 with claim 29 and the other claims in that group.

Claim 36

Claim 36 should be classified in group 6 with claims 29, 35 and the other claims in that group.

Claim 37

Claim 37 should be classified in group 6 with claims 29, 34-36 and the other claims in that group.

Claim 38

Claim 38 should be classified in group 6 with claims 29, 34-37 and the other claims in that group.

Claim 39

Claim 39 should be classified in group 6 with claims 29, 34-38 and the other claims in that group.

Claim 40

Claim 40 should be classified in group 6 with claims 29, 34-39 and the other claims in that group.

Claim 45

Claim 45 should be classified in group 6 with the other claims in that group.

Claim 46

Claim 46 should be classified in group 6 with the other claims in that group.

Claim 48

Claim 48 should be classified in group 6 with the other claims in that group.

Claim 50

Claim 50 should be classified in group 6 with the other claims in that group.

Claim 52

See group 5 above.

Claim 53

Claim 53 should be classified in group 4 with the other claims in that group.

Claim 58

Claim 58 should be classified in group 2 with the other claims in that group.

Claim 60

See group 5 above.

Claim 67

See group 5 above.

E. Claims 61-63 and 66 classified by the Examiner in a single group.

Claims 61-63 and 66 have been rejected over Tanaka in view of Lee. Claims 61-63 and 66 recite a receiver but not a transmitter. Claims 61-63 and 66 recite the use of matching filters techniques in the receiver. Claims 61-63 and 66 should accordingly be included in group 9 with claim 20.

F. Claims 64 and 65 classified by the Examiner in a single group.

Claims 64 and 65 have been rejected over Tanaka in view of Lee and Park. Claims 64 and 65 should be included in group 9 with claims 61-63 and 67.

G. Claims 68-70 and 73 classified by the Examiner in a single group.

Claims 68-70 and 73 have been rejected over Tanaka in view of Lee and Fulghum. Claim 68 recites a receiver but not a transmitter. It recites a plurality of multipliers each constructed to combine an individual one of transmitted data modulations and an individual one of transmitted spreading codes. The claim also recites a plurality of integrators, a plurality of spreading stages and a comparator. Claims 68-70 and 73 should be included in group 12 with claim 24.

H. Claims 71, 72 and 74 classified by the Examiner in a single group.

Claims 71, 72 and 74 have been rejected over Tanaka in view of Lee, Fulghum and Park. Claim 71, 72 and 74 are dependent from claim 68 which is classified with claims 69 and 73 in group 12. Since claims 71, 72 and 74 are dependent from claim 68, they should also be classified in group 12.

Applicants' grouping of claims may be summarized from the above discussions follows:

GROUP	CLAIMS
1	12
2	55, 58, 59, 84, 95
3	13-18,
4	51, 53, 54, 87
5	25, 26, 52, 60, 67, 93
6	27, 28, 29-40, 43, 44, 45, 46, 47, 48, 49, 50, 56, 57, 59, 75, 76, 77, 78, 79, 81, 85, 86, 88, 89, 94, 96, 97
7	21, 90
8	19
9	20, 61-66
10	22, 91
11	23, 92
12	24, 68-74
13	80, 82, 83
14	41, 42

VIII. Reasons for the Allowability of the Claims Over the Prior Art

A. Tanaka patent 5,781,542

Judging from the Office Action dated 03/26/2004 in this application, the Examiner apparently considers Tanaka to be the primary reference. Because of this, Tanaka will be considered first.

1. Tanaka does not select one of M data modulations in a sequence and one of N spreading codes in a sequence. Instead, Tanaka selects one <u>type</u> of a <u>multi-valued</u> modulation <u>system</u> from a plurality of <u>types</u> of <u>multi-valued</u> modulation <u>systems having different numbers of multi-valued modulations</u>. (Tanaka 2:21-40.) This selection of one type of a multi-valued modulation system from a plurality of types of multi-valued modulation systems cannot be considered the same as the selection of a data modulation from a plurality of data modulations. Claim 12 in group 1 is accordingly allowable over Tanaka whether Tanaka is applied individually or in combination with other references against the claim. This is

particularly true since, as will be seen from the subsequent discussion relating to the other prior art cited by the Examiner, none of the other prior art references even discloses data modulations.

2. Tanaka does not provide in a parallel pair the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence. Providing the selected data modulation and the selected spreading code in a parallel pair is advantageous. It insures that the selection of the data modulation and the spreading code will be provided simultaneously. It prevents errors from occurring because the modulation and the spreading code are not selected at different times.

Tanaka selects the spreading code at a different time from the selection of the spreading code. This may be seen from Figure 2 of Tanaka. In Figure 2, the selection of the type of multi-valued modulations occurs at 12. As indicated at 4:13:

> "The mapping and multi-valued modulation section 12 maps the information sequences output from the channel encoders 111-11m according to the multi-valued modulation system designated by the controller 20, <u>then</u> modulate the information sequences and outputs the sequences." (Underlining supplied.)

In Tanaka, the word "then" in the above quotation from Tanaka shows that the data modulations and the spreading codes are not provided in parallel. Tanaka thus indicates that the different types of modulation systems in a modulation sequence and the N spreading codes in a spread code sequence are not paired since the spread code signals are processed after the different type of the multi-valued modulation systems are processed. The other references are not applicable since they do not disclose data modulations. This causes claims 55, 58, 59, 84 and 95 in group 2

to be allowable over the cited references whether the references are applied individually or in combination against the claims.

3. Tanaka does not provide the sequences of the N spreading code signals alternately with the sequences of the different types of the multi-valued systems. Furthermore, Tanaka does not provide sequences of data modulations. Instead, Tanaka provides a plurality of types of multi-valued modulation systems having different numbers of multi-valued modulations. None of the other prior art references cited by the Examiner references even discloses data modulations. As a result, claims 13-18, in group 3 are allowable over the references whether the references are applied individually or in combination against the claims.

4. Tanaka does not provide a combination on a reiterative basis of a selected one of M data modulations and a selected one of N spreading codes. One reason is that Tanaka provides a plurality of types of multi-valued modulation systems having different numbers of multi-valued modulations. Another reason is that Tanaka does not disclose that whatever he does occurs on a reiterative basis. None of the other references cited by the Examiner even discloses data modulations. As a result, claim 51, 53, 54 and 87 in group 4 are allowable over the cited references whether the references are applied individually or in combination against the claims

5. Tanaka does not disclose that the M data modulations in each sequence and the N spreading codes in each sequence are provided in accordance with instructions from a receiver. Neither does any of the other references since these references do not disclose data modulations. As a result, claims 25, 26, 52, 54, 60, 67 and 93 in group 5 are allowable over the references cited by the Examiner whether the references are applied individually or in combination against the claims.

6. Tanaka does not disclose that the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence constitutes the product of the two (2) values. The multiplication of two (2) values electronically has to be provided by special circuits. These circuits are well known in the prior art. Tanaka does not disclose any special circuits for providing multiplication and does not indicate that a multiplication is being provided. The modulation sections 131-13m in Tanaka do not multiply selected ones of the data modulations from the modulation section 12 and selected ones of the spread codes from the controller 20. As Tanaka indicates at 4:18-22:

> "The spread spectrum modulation sections 131-13m spread spectrum modulate the multi-valued modulation signals output from the mapping and multi-valued modulation section by using the spreader designated by the controller 20 and outputs the multi-valued modulation signals. (Underlining supplied.) ."

A modulation as provided by Tanaka does not constitute a multiplication. This causes all of the claims in group 6 to be allowable over the cited references whether the references are applied individually or in combination against the claims.

B. Fulghum patent 5,345,469

Fulgham does not disclose data modulations. Because of this, Fulgham cannot disclose the selection of one of the M data modulations in a sequence and the combination of the selected one of M data modulations in a sequence and a selected one of N spreading codes in a sequence. Fulgham also cannot disclose that the combination constitutes a multiplication of the selected one of the M data modulations and the selected one of the N spread codes. Fulghum

further cannot disclose the parallel pairing of a selected one of the M data modulation in a sequence and the selected one of the N spreading codes in a sequence.

C. Park patent 6,160,840

Park also does not disclose data modulations. Because of this, Park cannot disclose the selection of one of M data modulations in a sequence and the combination of the selected one of the M data modulations in a sequence and a selected one of N spreading codes in a sequence. Park also cannot disclose that the combination constitutes a multiplication of the selected one of the M data modulations in the data modulation sequence and the selected one of the N spreading codes in the spreading code sequence. Park also cannot disclose the parallel pairing of the selected one of the M data modulations in the data modulation sequence and the selected one of the spreading codes in the spreading code sequence. This causes claims 27, 28, 29-40, 44, 45, 47, 48, 50, 56, 57, 59, 79, 81, 85, 86, 88, 89, 96 and 97 in group 6 to be allowable over the references whether the references are applied individually or in combination against the claims.

D. Lee patent 6,111,868

Lee does not disclose data modulation or a spreading code. Lee also does not multiply signals. In view of this, Lee does not provide any contribution to the rejection of applicants' claims.

E. The Allowability of the Claims Relating to Applicants' Receiver

None of the references discloses certain features recited by applicants in the receiver. For example, none of the references discloses an identification of the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence. See illustratively claims 21 and

90 in group 7. None of the references further discloses that the identification occurs by correlation techniques. See illustratively claims 22 and 92 in group 10. There is also no disclosure in any of the references that the correlation techniques are as shown in Figure 4 of applicants' drawings. See illustratively claims 24 and 68-74 in group 12.

The claims in the other groups (8, 9, 11, 13, and 14) also recite a receiver (but not a transmitter). The claims in these groups are allowable over the cited references whether the references are used individually or in combination because they recite the operation of the receiver in identifying the combination of the selected one of the data modulations in each data modulation sequence and the selected one of the spreading codes in each spreading code sequence. None of the cited references does this. Because of this, none of the cited references discloses the use of correlation techniques or matched filter techniques to accomplish this.

F. Improper Combinations of Prior Art References Applied Against the Claims

In order for different prior art references to be combined to reject a claim, the references have to disclose or suggest the combination recited in the claim. ACS Hospitality Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 221 USPQ 929 (Fed. Cir. 1984). As the Federal Circuit indicated in the ACS case at 732 F2d. 1577, 1579, 221 USPQ 929, 933:

> "Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination. Under Section 103, teaching of references can be combined if <u>only</u> there is some suggestion or incentive to do so."

None of the references cited by the Examiner to reject the claims in this application discloses or suggests certain of the features recited in the claims. This has been

discussed above in some detail. The references cannot accordingly be combined to reject the claims.

X. APPENDIX

CLAIMS ON APPEAL:

12. A method of transmitting data from a transmitter to a receiver, including the steps of:

providing a channel encoding of the information data,

providing a mapping of the channel encoded data,

providing a plurality of modulations of the mapped data in each of a plurality of M data modulation sequences,

providing a plurality of spreading codes in each of a plurality of N spreading code sequences,

selecting an individual one of the data modulations in each M data modulation sequence and an individual one of the spreading codes in each N spreading code sequence,

combining the selected one of the M data modulations in each M data modulation sequence and the selected one of the N spreading codes in each N spreading code sequence, and

transmitting to the receiver the combination of the selected one of the data modulations in each M data modulation sequence and the selected one of the N spreading codes in each N spreading code sequence.

13. A method as set forth in claim 12 wherein

the M data modulations are produced in first sequences and the spreading codes are produced in second sequences and wherein

the sequences of the data modulations and the sequences of the spreading codes are alternately provided and wherein

the M data modulations in each of the first sequences and the spreading codes in each of the alternately provided sequences of the spreading codes are paired in parallel and wherein

an individual one of the data modulations in the first sequences and an individual one of the spreading codes in the alternately provided sequences in each parallel pair of sequences are selected for combination.

14. A method of transmitting data and receiving the data, including the steps of:

providing data modulations in sequences each having M data modulations where M indicates the number of data modulations in each sequence,

providing spreading codes in sequences each having N spreading codes where N indicates the number of spreading codes in each sequence, the sequences of the N spreading codes being provided alternately with the sequences of the M data modulations,

selecting an individual one of the M data modulations in each sequence of the data modulations,

selecting an individual one of the N spreading codes in each spreading code sequence, and

combining the selected one of the M data modulations in each M data modulation sequence and the selected one of the N spreading codes in each N spreading code sequence.

15. A method as set forth in claim 14 wherein

the combination of the selected one of the M data modulations in each sequence of the M data modulations and the selected one of the N spreading codes in the next alternate one of the spreading code sequences is transmitted from the transmitter to the receiver.

16. A method as set forth in claim 14, including the steps of:

providing at the receiver successive combinations of the selected one of the M data modulations in each M data modulation sequence and the selected one of the N spreading codes in each alternate sequence of the N spreading codes, and

identifying ~~of~~ the combinations received at the receiver of the selected one of the M data modulations in each M data modulation sequence and the selected one of the N spreading codes in each N spreading code sequence.

17. A method as set forth in claim 16, including the step of:

demodulating the data modulations in each received combination after the identification of the received combination.

18. A method as set forth in claim 16, the step of:

despreading the spreading code in each received combination after the identification of the received combination.

19. A method as set forth in claim 16 wherein

each combination of the selected data modulation in each M data modulation sequence and the selected spreading code in each N spreading code sequence is subjected to correlation factors to identify the combination and wherein

the spreading code in each received combination is despread after the identification of the received combination and wherein

each received combination of the modulated data in each M data modulation sequence and the spreading code in each N spreading code sequence is demodulated after being despread.

20. A method as set forth in claim 18 wherein

each combination of the selected data modulation in the data modulation sequence and the selected spreading code in the spreading code sequence is passed through a plurality of matching filters, each having individual characteristics, to identify the characteristics of the combination in accordance with the characteristics of the filter through which the combination passes and wherein

the spreading code in each received combination is despread after the identification of the combination and wherein

each data modulation in each combination is demodulated after the combination is despread.

21. In a method of receiving and processing data from a transmitter, the steps of:

receiving at a receiver signals transmitted from the transmitter and constituting a combination of a selected one of M data modulations in a data modulation sequence and a selected one of N spreading codes in a spreading code sequence where M indicates the number of the data modulations in the data modulation sequence and N indicates the number of the spreading codes in the spreading code sequence,

identifying, from the different combinations of the M data modulations in the data modulation sequence and the N spreading codes in the spreading code sequence, the combination of the selected one of the M data modulations in the data modulation sequence and the selected one of the N spreading codes in the spreading code sequence, and

despreading and demodulating the combination of the selected one of the M data modulations in the data modulation sequence and the selected one of the N spreading codes in the spreading code sequence.

22. In a method as set forth in claim 21 wherein

correlation techniques are used to identify, from the combinations of the M data modulations in the data modulation sequence the N spreading codes in the spreading code sequence, the combination of the selected one of the M data modulations in the data modulation sequence and the selected one of the N spreading codes in the spreading code sequence.

23. In a method as set forth in claim 21 wherein

matched filter techniques are used to identify, from the combinations of the M data modulations in the data modulation sequence and the N spreading codes in the spreading code sequence, the combination of the selected one of the M data modulations in the data modulation sequence and the selected one of the N spreading code in the spreading code sequence.

24. In a method as set forth in claim 22 wherein

the received data is multiplied by each individual one of the N spreading codes in the correlation techniques and wherein

the individual ones of the products are integrated with time and wherein

the individual ones of the integrated products are squared and wherein

the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence is identified by the highest value in the squaring of the integrated products.

25. A method of transmitting data from a transmitter to a receiver, including the steps of:

encoding data in accordance with instructions from the receiver,

puncturing the data in accordance with instructions from the receiver,

interleaving the punctured data,

modulating the interleaved punctured data with a selected one of M data modulations in each of a plurality of data modulation sequence in accordance with instructions from the receiver,

spreading the modulated interleaved punctured data by a selected one of N spreading codes in each of a plurality of spreading code sequences in accordance with instructions from the receiver,

combining the selected one of the M data modulations in the data modulation sequence and the selected one of the N spreading codes in the spreading code sequence, and

transmitting to the receiver the modulated interleaved punctured data spread by the ~~particular~~ selected spreading code in each of the plurality of spreading code sequences.

26. A method as set forth in claim 25 wherein

the spreading codes are in sequences each having N spreading codes and wherein

an individual one of the M data modulations is selected in each data modulation sequence and wherein

the spreading code sequences alternate with the data modulation sequences and wherein

an individual one of the N spreading codes is selected in each spreading code sequence and wherein

the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence are combined and wherein

the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each alternate spreading code sequence is transmitted to the receiver.

27. A method as set forth in claim 26 wherein

the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence are provided in parallel to obtain the combination and wherein

the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each alternate spreading code sequence is provided by multiplying the selected one of the M data modulations and the selected one of the N spreading codes.

28. A method as set forth in claim 27 wherein

the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each alternate spreading code sequence are provided in parallel and wherein

the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence are selected with the M data modulations and the N spreading codes in parallel.

29. A method of transmitting data and receiving the data at a receiver, including the steps of:

providing the data at the transmitter,

providing sequences of M data modulations on a reiterative basis in accordance with instructions from the receiver where M indicates the number of the data modulations in the sequence,

providing sequence of N spreading codes on a reiterative basis in accordance with instructions from the receiver where N indicates the number of the spreading codes in the sequence,

alternately providing the sequences of the M data modulations and the sequences of the N spreading codes on a reiterative basis,

pairing in parallel on a reiterative basis successive ones of the sequences of the M data modulations and the sequences of the N spreading codes,

selecting from each parallel pair on a reiterative basis an individual one of the M data modulations in each data modulation sequence and an individual one of the N spreading codes in each spreading code sequence,

obtaining the product on a reiterative basis of the selected one of the M data modulations and the selected one of the N spreading codes in each parallel pair, and

transmitting to the receiver the product of the selected one of the M data modulations and the selected one of the N spreading codes in each parallel pair.

30. A method as set forth in claim 29, including the steps of

receiving at the receiver the product of the selected one of the M data modulations and the selected one of the N spreading codes in each parallel pair, and

identifying the product of the selected one of the M data modulations and the selected one of the N spreading codes in each parallel pair.

31. A method as set forth in claim 30, including the step of:

demodulating at the receiver the selected one of the M data modulations , in each identified product in accordance with instructions from the receiver, to recover the data in the product.

32. A method as set forth in claim 30, including the step of:

despreading at the receiver the individual one of the N spreading codes in each identified product, in accordance with instructions from the receiver, to recover the data in the product.

33. A method as set forth in claim 29, including the step of:

encoding the data at the transmitter, in accordance with instructions from the receiver, before the data is modulated.

34. A method as set forth in claim 30, including the steps of,

encoding the data at the transmitter, in accordance with instructions from the receiver, before the data is modulated and is combined with the spreading code to obtain the product, and

decoding the received product of the selected one of the M data modulations and the selected one of the N spreading codes in each parallel pair.

35. A method as set forth in claim 29, including the step of:

puncturing the data at the transmitter, in accordance with instructions from the receiver, before the data is modulated and combined with the spreading code to obtain the product.

36. A method as set forth in claim 29, including the steps of:

puncturing the data at the transmitter, in accordance with instructions from the receiver, to delete particular data before the data is modulated and combined with the spreading code to obtain the product, and

depuncturing the data at the receiver, in accordance with the instructions from the receiver, to restore the data punctured at the transmitter.

37. A method as set forth in claim 30, including the steps of:

puncturing the data at the transmitter, in accordance with instructions from the receiver, to delete particular data before the data is modulated and combined with the spreading code to obtain the product,

despreading at the receiver the identified product of each parallel pair of the selected one of the M data modulations and the selected one of the N spreading codes in each parallel pair,

demodulating at the receiver the despread data at the receiver, and

re-inserting at the receiver the punctured data into the demodulated data to recover the data.

38. A method as set forth in claim 29, including the steps of:

puncturing the data at the transmitter, in accordance with instructions from the receiver, before the data is modulated and combined with the spreading code to obtain the product, and

interleaving the punctured data at the transmitter before the data is modulated and combined with the spreading code to obtain the product.

39. A method as set forth in claim 30, including the steps of;

puncturing the data at the transmitter, in accordance with instructions from the receiver, to delete particular data before the data is modulated and is combined with the spreading code to obtain the product,

interleaving the punctured data at the transmitter before the data is modulated and combined with the spreading code to obtain the product,

de-interleaving the punctured data at the receiver after the selected one of the M data modulations and the selected one of the N spreading codes in each parallel pair has been identified, and

re-inserting the punctured data, in accordance with instructions from the receiver, before the decoding of the data but after the de-interleaving of the data.

40. A method as set forth in claim 39, including the steps of:

despreading at the receiver the selected one of the N spreading codes in each identified combination, in accordance with instructions from the receiver, to recover the data in the product, and

demodulating at the receiver the selected one of the M data modulations in each identified combination, in accordance with instructions from the receiver, to recover the data in the product.

41. In a method of receiving and processing data from a transmitter, the steps of:

receiving at a receiver from the transmitter modulated interleaved punctured data spread by a particular spreading code,

de-spreading the received data, in accordance with instructions provided by the receiver to the transmitter, to obtain the spreading of the data at the transmitter, the modulated interleaved punctured data constituting a product of modulated data selected from M data modulations in a data modulation sequence and a spreading code selected from N spreading codes in an N spreading code sequence where M is the number of the data modulations in the sequence and N is the number of the spreading codes in the sequence,

demodulating the modulated data in accordance with instructions provided by the receiver to the transmitter to modulate the data at the transmitter,

de-interleaving the demodulated data,

re-inserting the punctured data into the de-interleaved data in accordance with instructions provided by the receiver to the transmitter to obtain the puncturing of the data at the transmitter, and

decoding the data, after the re-insertion of the punctured data into the de-interleaved data, to recover the data.

42. In a method as set forth in claim 41 wherein the data received at the receiver from the transmitter constitutes a combination of a selected one of M data modulations in a data modulation sequence and a selected one of N spreading codes in a spreading code sequence where M is the number of the data modulations in the data modulation sequence and N is the number of the spreading codes in the spreading code sequence, the step of:

identifying, from the M data modulations in each data modulation sequence and the N spreading codes in each spreading code sequence, the selected one of the M data modulations in the data modulation sequence and the selected one of the N spreading codes in the spreading code sequence, the identification occurring before the demodulation and the de-spreading of the received data.

43. Apparatus for transmitting data from a transmitter to a receiver including:

a bus for providing successive sequences of M data modulations and successive sequences of N spreading codes where M is the number of the data modulations in each data modulation sequence and N is the number of the spreading codes in each spreading code sequence,

a converter for converting each of the successive sequences of the M data modulations and the N spreading codes to a parallel presentation of the M data modulations in each data modulation sequence and the N spreading codes in each successive spreading code sequence,

a first selector for selecting an individual one of the M data modulations in each of the parallel presentations,

a second selector for selecting an individual one of the N spreading codes in each of the parallel presentations,

a multiplier for combining the selected one of the M data modulations in each parallel presentation and the selected one of the N spreading codes in the parallel presentation, and

a transmitter for transmitting the multiplied combination of the selected one of the M data modulations and the selected one of the spreading codes in each of the parallel presentations.

44. Apparatus as set forth in claim 43, including

an encoder for encoding the successive sequences of the data before the modulation of the data with the M data modulations in each sequence and before the spreading of the modulated data with the N spreading codes in each sequence.

45. Apparatus as set forth in claim 43, including

an interleaver for interleaving the encoded data.

46. Apparatus as set forth in claim 43, including

a stage for puncturing the data in the successive sequences in accordance with instructions from the receiver before the introduction of the M data modulations and the N spreading codes to the converter.

47. Apparatus as set forth in claim 43, including

the M data modulations introduced to the converter in each data modulation sequence being provided in accordance with instructions from the receiver,

the N spreading codes introduced to the converter in each spreading code sequence being provided in accordance with instructions from the receiver.

48. Apparatus as set forth in claim 43, including

a stage for interleaving the data in the successive sequences in accordance with instructions from the receiver before the introduction of the M data modulations in each data modulation sequence and the N spreading codes in each spreading code sequence to the converter.

49. Apparatus as set forth in claim 43, including

the modulator modulating the data with sequences of M data modulations in accordance with instructions from the receiver,

the code spreader spreading the data with sequences of N spreading codes in accordance with instructions from the receiver,

the modulator and the code spreader being operative before the selections provided by the first and second selectors.

50. Apparatus as set forth in claim 44, including

a stage for puncturing the data in the successive sequences before the introduction of the M data modulations in each data modulation sequence and the N spreading codes in each spreading code sequence to the converter,

a stage for interleaving the data in the successive sequences before the introduction of the M data modulations in each data modulation sequence and the N spreading codes in each spreading code sequence to the converter,

a modulator for modulating the data in the sequences of the M data modulations in accordance with instructions from the receiver,

a code spreader for spreading the data in the sequences of the N spreading codes in accordance with instructions from the receiver,

the modulator and the code spreader being operative before the selections provided by the first and second selectors, and

the transmitter being operative to transmit the combination of the selected one of the M data modulations in each of the successive data modulation sequences and the selected one of the N spreading codes in each of the successive spreading code sequences.

51. Apparatus for transmitting data from a transmitter to a receiver, including,

an encoder for providing coded channels identifying relative locations of the data,

a modulator for providing sequences of M data modulations in accordance with instructions from the receiver where M is the number of the data modulations in each data modulation sequence,

a code spreader for providing sequences of N spreading codes in accordance with instructions from the receiver where N is the number of the spreading codes in each spreading code sequence and where the sequences of the N spreading codes are juxtaposed to the sequences of the M data modulations,

a converter for converting to a parallel relationship each of the successive encoded sequences of the M modulated data and each of the juxtaposed sequences of the N spreading codes,

a first selector of an individual one of the M data modulations in each data modulation sequence,

a second selector of an individual one of the N spreading codes in the juxtaposed spreading code sequence, and

a stage for combining on a reiterative basis the selected one of the M data modulations in each data modulation sequence and

the selected one of the N spreading codes in the juxtaposed spreading code sequence to produce resultant signals, and

a stage for transmitting the resultant signals in each data modulation sequence and spreading code sequence to the receiver.

52. Apparatus as set forth in claim 51, including

a stage for removing particular ones of the data sequences, before the modulation of the data with the M data modulations and before the spreading of the data with the N spreading codes, in accordance with instructions from the receiver.

53. Apparatus as set forth in claim 51, including,

a stage for interleaving the data in the sequences before the modulation of the data with the M data modulations in each data modulation sequence and before the spreading of the data with the N spreading codes in each spreading code sequence.

54. Apparatus as set forth in claim 51, including,

a converter for converting the M data modulations in each data modulation sequence and the N spreading codes in the juxtaposed spreading code sequence to a parallel presentation,

the first and second selectors being operative after the conversion of the M data modulations in each data modulation sequence and the conversion of the N spreading codes in the juxtaposed spreading code sequence to the parallel presentation.

55. Apparatus for providing a transmission of data from a transmitter to a receiver, including:

a bus for providing data,

a modulator for modulating the data, each with sequences of M data modulations where M is the number of the data modulations in each sequence, and

a spreader for spreading the modulated data, each with sequences of N spreading codes where N is the number of the spreading codes in each spreading code sequence,

a converter for converting the M data modulations in each data modulation sequence and the N spreading codes in each spreading code sequence to a parallel presentation where each sequence of the M data modulations is juxtaposed with an individual one of the sequences of the N spreading codes,

a first selector for selecting an individual one of the M data modulations in each parallel presentation,

a second selector for selecting an individual one of the N spreading codes in each parallel presentation, and

a stage for combining the selected one of the M data modulations in each parallel presentation and the selected one of the N spreading codes in the parallel presentation.

56. Apparatus as set forth in claim 55 wherein

the M data modulations in each data modulation sequence are provided in accordance with instructions from the receiver and wherein

the N spreading codes in each juxtaposed spreading code sequence are provided in accordance with instructions from the receiver and wherein

the combination of the selected one of the data modulations in each parallel presentation and the selected one of the N spreading codes in the parallel presentation constitutes the product of the data modulation and the spreading code.

57. Apparatus as set forth in claim 55, including

a transmitter for transmitting to the receiver the product of the selected one of the M data modulations and the selected one of the N spreading codes in each parallel presentation.

58. Apparatus as set forth in claim 55 wherein

a puncturer is provided to remove data in the sequences, before the modulation of the data with the M data modulations in each data modulation sequence and before the spreading of the data with the N spreading codes in the juxtaposed spreading code sequence, in accordance with instructions from the receiver.

59. Apparatus as set forth in claim 55 wherein

an encoder provides channel coding to the data in the sequences before the modulation of the data with the M data modulations in each data modulation sequence and before the spreading of the data with the N spreading codes in each spreading code sequence.

60. Apparatus as set forth in claim 55 wherein

the M data modulations in each data modulation sequence are provided in accordance with instructions from the receiver and wherein

the N spreading codes in each spreading code sequence are provided in accordance with instructions from the receiver and wherein

a puncturer is provided to remove data in each sequence, before the modulation of the data in each sequence with the M data modulations and before the spreading of the data in the

juxtaposed sequence with the N spreading codes, in accordance with instructions from the receiver and wherein

an encoder provides channel coding to the data in the sequences before the modulation of the data in each data modulation sequence with the M data modulations and before the spreading of the data in the juxtaposed spreading code sequence with the N spreading codes.

61. Apparatus for receiving and processing data from a transmitter, including

a bus for receiving transmitted data representing a combination of an individual one of M data modulations in a data modulation sequence and an individual one of the N spreading codes in a spreading code sequence juxtaposed to the sequence of the M data modulations where M is the number of the data modulations in the data modulation sequence and N is the number of the spreading codes in the spreading code sequence,

a plurality of matched filters disposed in a parallel relationship, each of the filters providing characteristics corresponding to a combination of the individual one of the M data modulations in the data modulation sequence and the individual one of the N spreading codes in the spreading code sequence and each operative to receive the data on the bus and to provide an output dependent upon the matching between the characteristics of the filters and the characteristics of the data on the bus, and

a comparator responsive to the output of the matched filters for comparing the magnitude of the outputs from the matched filters in the plurality to select the output with the highest magnitude.

62. Apparatus as set forth in claim 61 wherein the data has been spread by the N spreading codes in the sequence in accordance with instructions from the receiver; the apparatus including:

a de-spreader at the receiver for removing the spreading codes in the data.

63. Apparatus as set forth in claim 61 wherein the data has been modulated by the M data modulations in the sequence on a reiterative basis in accordance with instructions from the receiver, the apparatus including:

a demodulator at the receiver for removing the modulations in the data.

64. Apparatus as set forth in claim 61 wherein the data has been punctured in a particular pattern at the transmitter, in accordance with instructions from the receiver, to eliminate portions of the data, the apparatus including:

a de-puncturer for restoring at the receiver the portions of the data eliminated at the transmitter.

65. Apparatus as set forth in claim 61 wherein the data has been interleaved at the transmitter,

the apparatus including

a de-interleaver for de-interleaving the data.

66. Apparatus as set forth in claim 61 wherein the data has been encoded at the transmitter to identify the channels in which the data is provided,

the apparatus including:

a decoder at the receiver for eliminating the channel coding.

67. Apparatus as set forth in claim 61 wherein the data has been modulated at the transmitter by the M data modulations in the sequence in accordance with instructions from the receiver and wherein the data has been interleaved at the transmitter and wherein the data has been punctured at the transmitter in accordance with instructions from the receiver and wherein the data has been spread by the N spreading codes in the sequence in accordance with instructions from the receiver the apparatus including:

a despreader at the receiver for removing the spreading codes in the data,

a demodulator at the receiver for demodulating the M data modulations,

a de-interleaver at the receiver for de-interleaving the data,

a de-puncturer at the receiver for depuncturing the data, and

a decoder at the receiver for decoding the encoded data.

68. Apparatus for receiving data from a transmitter, including

a bus for receiving transmitted data representing a combination of an individual one of M data modulations in a data modulation sequence and an individual one of N spreading codes in a juxtaposed spreading code sequence where M is the number of the data modulations in the data modulation sequence and N is the number of the spreading codes in the spreading code sequence,

a plurality of multipliers each constructed to combine an individual one of the transmitted data modulations and an individual one of the spreading codes to provide an output representative of the combination,

a plurality of integrators each operatively coupled to an individual one of the multipliers to integrate over a particular period of time the output from the individual one of the multipliers,

a plurality of squaring stages each operatively coupled to the individual one of the integrators for squaring the output of the individual one of the integrators, and

a comparator responsive to the outputs of the squaring stages for selecting the individual one of the squaring stages with the largest output and operatively coupled to the integrators for selecting for its output the output of the individual one of the integrators operatively connected to the individual one of the squaring stages.

69. Apparatus as set forth in claim 68 wherein the data has been spread by N spreading codes in accordance with instructions from the receiver, the apparatus including:

a de-spreader for restoring the data to the form at the transmitter before the spreading at the transmitter by the N spreading codes.

70. Apparatus as set forth in claim 68 wherein the data has been modulated by M data modulations in accordance with instructions from the receiver, the apparatus including:

a demodulator for restoring the data to the form at the transmitter before the modulation at the transmitter by the M data modulations.

71. Apparatus as set forth in claim 68 wherein the data has been punctured in a particular pattern at the transmitter, in accordance with instructions from the receiver, to eliminate portions of the data, the apparatus including:

a de-puncturer for restoring at the receiver the portions of the data eliminated at the transmitter.

72. Apparatus as set forth in claim 68 wherein the data has been interleaved at the transmitter,

the apparatus including

a de-interleaver for returning the data at the receiver to the form at the transmitter before the interleaving of the data.

73. Apparatus as set forth in claim 68 wherein the data has been encoded at the transmitter to identify the channels in which the data appears:

the apparatus including:

a decoder for returning the data at the receiver to the form at the transmitter before the encoding of the data by the encoder.

74. Apparatus as set forth in claim 69 wherein the data has been modulated at the transmitter in accordance with instructions from the receiver and has been interleaved at the transmitter and has been punctured with a particular pattern at the transmitter, in accordance with instructions from the receiver, to eliminate portions of the data and has been encoded at the

transmitter, in accordance with instructions from the receiver, to identify channels in which the data is provided, the apparatus including:

a demodulator at the receiver for restoring the data to the form at the transmitter before the modulation at the transmitter by the M data modulations,

a de-interleaver at the receiver for returning the data at the receiver to the form at the transmitter before the interleaving of the data,

a de-puncturer at the receiver for restoring at the receiver the portions of the data eliminated at the transmitter, and

a decoder for returning the data at the receiver to the form at the transmitter before the encoding of the data by the encoder.

75. A method as set forth in claim 14 wherein

the combination constitutes the product of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence.

76. A method as set forth in claim 12 wherein

the combination constitutes the product of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence.

77. A method as set forth in claim 13 wherein

the combination constitutes the product of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in the spreading code sequence.

78. A method as set forth in claim 14 wherein

the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in the next alternate sequence of the spreading codes are in parallel and wherein

the combining is defined by the product of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in the next alternate sequence of the spreading codes in parallel.

79. A method as set forth in claim 78, including the steps of

providing at the receiver successive combinations of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in the next alternate sequence of the spreading codes, and

identifying the combination received at the receiver of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each next alternate sequence of the spreading codes.

80. A method as set forth in claim 79 wherein

each combination of the selected data modulation in each data modulation sequence and the selected spreading code in each spreading code sequence is subjected to correlation factors to identify the combination and wherein

the spreading code in each received combination is despread after the identification of the received combination and wherein

each received combination of the modulated data and the spreading code is demodulated after being despread.

81. In a method as set forth in claim 21 wherein

the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence constitutes the product of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence.

82. In a method as set forth in claim 81 wherein

correlation techniques are used to identify, from the combinations of the M data modulations in each data modulation sequence and the N spreading codes in each spreading code sequence, the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence

the received data is multiplied by each individual one of the N spreading codes in the correlation techniques and wherein

the individual ones of the products are integrated with time and wherein

the individual ones of the integrated products are squared and wherein

the combination of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence is identified by the highest value in the squaring of the integrated products.

83. Apparatus as set forth in claim 80 wherein

the combining of the selected one of the M data modulations in each data modulation sequence and the selected one of the N spreading codes in each spreading code sequence constitutes the product of the selected one of the data modulations in each data modulation sequence and the selected one of the spreading codes in each spreading code sequence.

84. A method of transmitting data from a transmitter to a receiver, including the steps of:

providing successive sequences of a plurality of modulation symbols for the data,

providing a spreading code for the data,

providing a parallel presentation of each of the modulation symbols for the data and the spreading code for the data and

combining each of the parallel presentations to provide signals representation of the presentations.

85. A method as set forth in claim 84 wherein

the combination constitutes the product of each of the modulation symbols for the data and the spreading code for the data.

86. A method as set forth in claim 85, including the step of:

selecting the product of successive ones of the modulations in each sequence and the spreading codes with juxtaposed sequences, and

transmitting the successive ones of the products to the transmitter.

87. A method of transmitting data from a transmitter to a receiver, including the steps of:

providing input signals,

mapping the input signals with a number of binary bits,

providing a spreading code,

modulating the input signals from the mapper with reiterative sequences of M data modulations where M indicates a number of different data modulations,

selecting each successive one of the M modulations in each reiterative sequence, and

combining each successive one of the M modulations in each reiterative sequence and the spreading code.

88. A method as set forth in claim 87, including

multiplying the combination of each successive one of the M modulations in each reiterative sequence and the spreading code.

89. A method as set forth in claim 88 wherein

each successive one of the M data modulations in each reiterative data modulation sequence is presented in parallel with the spreading code and wherein

the parallel presentation of each successive one of the M data modulations in each reiterative data modulation sequence and the spreading code is multiplied, and wherein

the product of each successive one of the M data modulations in each reiterative data modulation sequence and the spreading code is transmitted to the receiver.

90. In a method of receiving and processing data from a transmitter, the steps of:

receiving at a receiver signals transmitted from the transmitter and constituting a combination of a selected one of M data modulations in a data modulation sequence and a spreading code where M indicates the number of the data modulations in the sequence,

identifying, from the combinations of the M data modulations in the data modulation sequence and the spreading code, the combination of each selected one of the M data modulations in the data modulation sequence and the spreading code, and

despreading and demodulating the combination of each selected one of the M data modulations in the data modulation sequence and the spreading code.

91. In a method as set forth in claim 90 wherein

correlation techniques are used to identify, from the combinations of the M data modulations in the data modulation sequence and the spreading code, the combination of each selected one of the M data modulations in the data modulation sequence and the spreading code.

92. In a method as set forth in claim 90 wherein

matched filter techniques are used to identify, from the combination of the M data modulations in the data modulation sequence and the spreading code, the combination of each selected one of the M data modulations in the data modulation sequence and the spreading code.

93. A method of transmitting data from a transmitter to a receiver, including the steps of:

encoding data in accordance with instructions from the receiver,

puncturing the data in accordance with instructions from the receiver,

interleaving the punctured data,

modulating the interleaved punctured data with a selected one of M data modulations in a data modulation sequence in accordance with instructions from the receiver where M is the number of data modulation in the data modulation sequence,

combining each selected one of the M data modulations in the data modulation sequence and a particular spreading code, and

transmitting the combination of each selected one of the M data modulations in the data modulation sequence and the particular spreading code to the receiver.

94. A method as set forth in claim 93 wherein

the combination constitutes the product of each selected one of the M data modulations in the data modulation sequence and the particular spreading code.

95. A method of transmitting data and receiving the data at a receiver, including the steps of:

providing the data at the transmitter,

providing a sequence of M data modulations in accordance with instructions from the receiver where M indicates the number of the data modulations in the sequence,

providing a spreading code in accordance with instructions from the receiver,

pairing in parallel successive ones of the M data modulations in each data modulation sequence and the spreading code where M is the number of the data modulations in each data modulation sequence ,

selecting from the parallel pairs in each data modulation sequence an individual one of the pairing of the M data modulations in each data modulation sequence and the spreading code,

combining in each data modulation sequence the M data modulation and the spreading code in the selected pair, and

transmitting to the receiver in each data modulation sequence the combination of the M data modulation and the spreading code in the selected pair.

96. A method as set forth in claim 95 wherein

the combination in each data modulation sequence of the M data modulation and the spreading code in the selected pair constitutes the product in each data modulation sequence of the M data modulation and the spreading code in the selected pair.

97. A method as set forth in claim 96, including the steps of:

receiving at the receiver the product in each data modulation sequence of the M data modulation and the spreading code in the selected pair, and

identifying at the receiver the product in each data modulation sequence of the data modulation and the spreading code in the selected pair.

IX Conclusion

Reconsideration and allowance of the application are respectfully requested.

Respectfully submitted,

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